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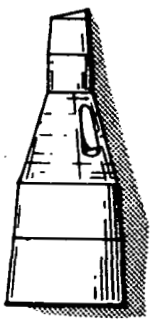
NASA Program Gemini Working Paper No. 5014

EXPERIMENTS FOR GT-3 MISSION



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September 22, 1964

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EXPERIMENTS FOR GT-3 MISSION

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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1.0 INTRODUCTION

A variety of scientific experiments will be conducted on the Gemini Program missions to extend man's knowledge of space and to further develop his ability to sustain life in the space environment.

This document presents detailed information concerning the four experiments to be conducted on the GT-3 mission. These data are to be used for informational purposes to become more familiar with the experiments and with the requirements and responsibilities necessary for the successful accomplishment of the experiments.

This document may be used as a reference and for planning additional experiments for future space flights. It will be updated when necessary to reflect changes in the equipment, procedures, or details of the experiments.

2.0 POSTFLIGHT EVALUATION REPORTING

The four experiments will be conducted essentially as described in this document. The preflight, inflight, and postflight procedures are included to the point that the experimental equipment is returned to the conducting organizations for evaluation. These organizations are responsible for performing the postflight evaluation and for providing detailed reports of the results obtained. If possible, these reports should be completed in time to be included in section 8 of the Gemini Program Mission Report for the GT-3 Mission. If the evaluation of any experiment has not been completed within the 30-day time limit established for publication of the mission report, a preliminary report will be submitted to meet this deadline. For all such experiments, the complete, detailed results of the experiment will be reported later in the form of a supplemental report to the basic mission report. Supplemental report numbers will be assigned when this requirement becomes necessary. For more information on preparation of the basic or supplemental reports, refer to Gemini Working Paper No. 5008 and Supplement C thereto.

3.0 EXPERIMENT NUMBER M-2 – CARDIOVASCULAR EFFECTS OF SPACE FLIGHT

3.1 Justification

Evidence obtained from Project Mercury flights suggest that prolonged orbital conditions produce an alteration in the pilot's cardiovascular responses to position changes. The medical examinations performed immediately after spacecraft recovery indicated a deleterious effect of the ability of the pilot to maintain a normal blood pressure in the postflight erect position. This experiment is designed to further investigate this phenomenon and evaluate the effects of prolonged weightlessness on the overall cardiovascular system. It will obtain more quantitative measurements to assess the magnitude and significance for future manned space flights. This experiment will be conducted by the Space Medicine Branch of the Crew Systems Division of the NASA Manned Spacecraft Center, Houston, Texas, and is sponsored by the NASA Office of Manned Space Flight (OMSF), Washington, D.C.

3.2 Scope

This experiment will determine the extent of cardiovascular reflex deconditioning and any changes in the total circulating blood volume of both astronauts during the GT-3 mission. Comparisons will be made of the astronauts' preflight and postflight blood pressures, blood volumes, pulse rates, and electrocardiograms. These data will reveal the cardiovascular and blood volume changes due to heat stress, the effect of prolonged confinement, dehydration, fatigue, and possible effects of weightlessness. Some compensatory cardiovascular reactions are expected, but large variations may indicate a possible hazard to manned space flights. This experiment is part of a continuing study into the medical effects of the space environment.

3.3 Description

This experiment consists of measuring certain cardiovascular parameters of the two GT-3 astronauts before and after their orbital flight. There are no inflight requirements for this experiment. Measurements of pulse, blood pressures, and electrocardiograms (ECG) will be taken before, during, and after a head-up tilt of 80° from the horizontal. The tilt tests will be performed on a tilt table consisting of a Stokes' litter attached to a desk or table as illustrated in figure 3-1. The astronaut will be comfortably secured in the litter by a restraint harness across the upper chest to prevent circulatory interference in the lower extremities. This arrangement will minimize muscle tension and blood vessel

occlusion during the tilt. The astronaut will be placed in the horizontal position for approximately 20 minutes before the tilt to allow stabilization of his body functions. The movement to the 80° tilt position will be accomplished in 3 to 4 seconds and the astronaut will remain in the tilted position for approximately 15 to 20 minutes. The astronaut will then be returned to the horizontal position for an additional 10 minutes. Quantitative systolic and diastolic blood pressure measurements will be taken at 2-minute intervals prior to, during, and for 10 minutes after tilt. Electrocardiograms and pulse rate will be continuously recorded during the experimental procedure. There will be three preflight and five postflight tilt-test procedures. In addition to the pulse rate, blood pressure, and ECG measurements for each tilt test, a blood volume determination will be made after completion of the third preflight test and after the first and fifth postflight tests. The blood volume determination will be made using the radioactive isotope serum of albumin (RISA) technique. Comparisons of preflight and postflight data obtained from this experiment will help to determine the effects of prolonged weightlessness on the overall cardiovascular system.

3.4 Preflight Considerations

3.4.1 Tilt tests.- The three preflight tilt tests of each of the GT-3 astronauts will be conducted at the NASA Manned Spacecraft Center in Houston, Texas. The actual schedule for the tests will comply with the available time of the astronauts involved. The third test, which includes the blood volume determination, will be conducted prior to the astronauts' departure for Cape Kennedy to make final preparations for the GT-3 mission.

3.4.2 Recovery area.- Due to the requirement for measurements of the astronauts' cardiovascular parameters upon egress from the spacecraft, it is necessary that medically qualified personnel familiar with the equipment and techniques involved in this experiment be present in the primary recovery area. A minimum of two such personnel plus one instrument technician will be aboard the primary recovery vessel. Accompanying these personnel will be the Stokes' litter upon which the tilt test will be performed, the two-channel portable biomedical recorders to measure blood pressures and ECG, storage and disposal facilities for the blood volume determination radioactive isotopes, and other necessary medical equipment.

The activities aboard the recovery ship will require the use of suitable space in the ship's medical facility. Each of these personnel will board the primary recovery vessel prior to the vessel's departure from the U.S. mainland.

3.5 Inflight Considerations

There are no inflight requirements or considerations for this experiment. An accurate record of all food and liquid consumed, and of urine expelled, by each astronaut during the flight will be kept as a matter of flight routine. This record will be used in comparing the blood volumes obtained before and after the flight.

3.6 Postflight Considerations

3.6.1 Primary recovery area.- Upon recovery of the spacecraft, situation and conditions permitting, the astronauts will remain in the spacecraft while it is hoisted on board the prime recovery vessel. As soon as recovery personnel have secured the spacecraft and opened the hatches, the astronauts will be prepared for egress from the spacecraft. This will consist of disconnecting the astronauts from the spacecraft life support, communications, and restraint systems. The experiment medical personnel will locate two portable biomedical recorders adjacent to the spacecraft on the recovery vessel's deck. One recorder will be connected to each astronaut by a 12-foot cable from the recorder to the spacesuit biomedical connection. The spacesuit blood pressure recording cuff will be manually inflated. The recorders will be turned on and measurements taken of each astronaut's blood pressure and ECG. Each astronaut will then egress from the spacecraft and stand on the recovery vessel's deck. Blood pressure and ECG measurements will be recorded automatically before, during, and for a short time after egress from the spacecraft. The recorders will then be disconnected and the astronauts escorted to the ship's medical facility.

The astronauts will immediately be given the first tilt table test followed by a blood volume determination. No food or fluids should be consumed by the astronauts until this blood volume determination has been completed. They will then be allowed to eat and drink, but an accurate record of input and output volume must be kept for the next 18 hours. This record will be correlated with any blood volume changes observed as a result of the orbital flight.

Within 2 hours after egress from the spacecraft, the astronauts will undergo the second tilt test. ECG measurements will be taken continuously during the test procedures using the portable biomedical recorders. After the astronauts have removed their spacesuits, ECG readings will be obtained from sensors applied directly to the skin. Blood pressure measurements will be taken manually. The third tilt test will be performed approximately 4 hours after egress, the fourth approximately 8 hours after egress, and the fifth approximately 18 hours after egress. A second postflight blood volume determination will be made after completion of the fifth tilt test.

After all data have been thoroughly analyzed, the results will be made available to the NASA Gemini Program Office.

3.6.2 Secondary recovery area.- If the spacecraft is recovered in a secondary or contingency area, appropriate tilt tests will be made as soon as medically qualified personnel can reach the astronauts. If possible, an accurate record of fluid input and output volume will be maintained until completion of this experiment.

3.7 Installation Procedures

Installation procedures are not applicable to this experiment.

3.8 Checkout Procedures

Checkout procedures are not applicable to this experiment.

3.9 Flight Qualification Requirements

This experiment has no flight equipment and requires no inflight procedures or considerations. Flight qualification procedures are not applicable.

Figure 3-1.- Stokes' litter used as a tilt table for cardiovascular effects experiment.

4.0 EXPERIMENT NUMBER S-2 (POISE 80) - EFFECTS OF ZERO GRAVITY ON THE GROWTH OF SEA URCHIN EGGS

4.1 Justification

This experiment is designed to explore the possibility of the existence of a gravitational field effect on cells exposed to low-gravity conditions. Such an effect is of special interest to manned space flight programs. Long-term weightlessness may have cellular effects that would be important to prolonged space flights. Such cellular effects are much more easily detectable in simple cell systems rather than in complex organisms capable of internal regulations. Theoretical scientific studies indicate that, if it exists at all, cellular effects should appear in cells above a minimal size of 1 to 10 microns diameter. This experiment will provide a study of echinoderm (sea urchin) eggs during a very sensitive stage of their development while exposed to the zero gravity of space. Upon completion of the experiment, all test material will be examined for gross morphological aberrations as well as histological abnormalities. This experiment should cast light on the role of gravity (if any) on such fundamental cellular phenomena as fertilization, cell division, differentiation, and morphogenesis; processes on which gravity may have some intercellular influence. It was designed for the GT-3 mission and will be conducted by the NASA Ames Research Center, Moffett Field, California. This experiment is sponsored by the NASA Office of Space Sciences (OSS), Washington, D.C.

4.2 Scope

This experiment will investigate zero-gravity effects on sea urchin eggs during very sensitive stages of development, such as fertilization and cell division. The use of sea urchin eggs to investigate possible gravitational cellular effects offers certain advantages. The egg cell is well above the theoretical minimum size of 1 to 10 microns diameter. Cell division can be activated at will (by fertilization during flight) and accurately timed so that any effect on the mitotic apparatus can be observed. Cell mobility (the ability of sperm to fertilize the egg) and cell differentiation and morphogenesis can be easily studied. For comparison purposes, a similar series of control samples will be developed simultaneously on the ground. In the laboratory, the sea urchin egg cell has demonstrated no effects to different gravitational fields. The exposure of the eggs to zero gravity under controlled conditions will ascertain whether or not any such low gravity effects do exist.

If the results are positive, future experiments will be planned to investigate the mechanics of this phenomenon more fully. If the cells,

as expected, do not demonstrate an effect due to the low gravity, then the results of this experiment will be used as a control in comparing the effects of subgravity on cells which do exhibit effects due to different gravitational fields. An example of this type cell is the amphibian (frog) egg, which also meets the size requirements. Plans and equipment are being developed to test cells of this type on later Gemini missions.

4.3 Description

4.3.1 Operation.- This experiment consists of a metal capsule containing eight separate samples of sea urchin eggs, sperm, and a fixative solution. The capsule and its Gemini spacecraft location are shown in figure 4-1.

At designated times, the eggs and the sperm will be united to start the fertilization and growth process. After a specified time interval, the fixative solution will be applied to the egg embryo to stop its growth. Four samples will be fertilized on signal while still on the launch pad, timed so that first cell division will occur soon after the onset of the zero gravity phase of the GT-3 mission. Two of these first four samples will be fixed between the first and second cell divisions. The remaining four samples will be fertilized soon after the onset of the zero gravity phase of the mission. Two of these samples and the remaining two samples from the first four will be fixed after approximately 50 minutes of growth under zero gravity. The remaining two samples will be fixed immediately before reentry. Upon recovery, all samples will be examined for gross morphological aberrations and histological abnormalities. The planned capsule activation schedule will allow recovery of the sea urchin egg embryos in the first, third, and fourth cell division, and the early blastulae stage. The optimum capsule temperature for this experiment is 68° F. Deviations to $\pm 10^{\circ}$ F will still yield the embryo stages desired, but to a lesser degree. Variations in the operation times will also affect the percentage of embryo stages obtained. It is necessary that a record be kept of the spacecraft temperatures during the flight and the real time activation of the five operations of the experiment. As an additional check, a temperature recorder is built into the capsule and records the actual temperatures sustained inside the capsule. A like sample of eggs and sperm housed in a similar capsule will be fertilized and fixed simultaneously on the ground at the GT-3 launch site. The ground control sample will be subjected to a temperature profile similar to that experienced by the flight sample during the flight. Postflight examination of the growth and differentiation of the cells exposed to space flight will be compared with results obtained from the identical ground experiment. The astronaut must give real-time notification of each operation to a ground station so that the activation of the ground experiment may be synchronized with the flight experiments.

4.3.2 Equipment.- The experiment material is housed in a cylindrical capsule illustrated in figure 4-2. It is $3\frac{1}{4}$ inches in diameter and $6\frac{3}{4}$ inches long, including the handle. The capsule is a sealed container with vacuum insulation and weighs 25.4 ounces. It consists of eight specimen chambers, each divided into separate compartments for sperm, ova, and fixative solution. Mixing of these materials is effected by a two-step operation, the first for fertilization, and the second for fixing the fertilized eggs to inhibit their growth at various stages of development. Rotation of the handle, located at one end of the capsule, activates either the fertilization or the fixation process within the various chambers. The actual sequence of operations is prearranged by capsule design. This experiment consists of five scheduled operations. Each operation consists of manually turning the handle to the right to a positive stop (approximately 12°) and then releasing it. The handle returns to the start position automatically and is ready for the next operation. The first operation will fertilize chambers 1, 2, 3, and 4 and the second will fertilize chambers 5, 6, 7, and 8. Operation 3 will fix chambers 1 and 2; operation 4 will fix chambers 3, 4, 5, and 6, and operation 5 will fix chambers 7 and 8.

4.4 Preflight Considerations

4.4.1 Launch site.- Since the sea urchin eggs and sperm are very sensitive to time and temperature variations, success of this experiment depends on it being placed on-board the GT-3 spacecraft as near as possible to launch time. The experiment material must be kept refrigerated until it is prepared for insertion into the spacecraft. For these reasons, all preflight preparation, assembly, and testing of the flight capsule must be performed as near as possible to the GT-3 launch site. Four personnel representing the ARC will arrive at Cape Kennedy approximately seven days before the scheduled launch date to prepare the flight and ground control capsules. Necessary Cape Kennedy utility services and liaison with appropriate NASA personnel must be established to provide these ARC personnel with spacecraft inflight real-time information regarding cabin temperatures and astronaut verified experiment operation times. The flight capsule will be prepared and delivered to predesignated personnel for installation into the spacecraft. The time of installation must be programed into the GT-3 countdown procedures approximately 120 minutes or less before scheduled launch. Reasonably gentle handling and protection from extreme temperatures (below 36° F and above 90° F) is required for the capsule. The capsule will be inserted into and secured to the mounting bracket on the left-hand hatch of the spacecraft as illustrated in figure 4-3. No other interface with any spacecraft system is required.

The first scheduled operation (fertilization of chambers 1, 2, 3, and 4) for this experiment must be programed into the GT-3 countdown procedures at 30(±5) minutes before launch. At that time the command astronaut will turn the experiment capsule handle to the right to the positive stop and release it. He will report the time of this operation and the spacecraft cabin temperature to the Cape Kennedy Mission Control Center (MCC). The MCC will relay these data to the ARC personnel who will then perform operation number one on the ground control capsule. The ground control capsule environment will be maintained as close to the spacecraft cabin temperature as possible.

4.4.2 Recovery area.- Due to the desirability of return of the capsule to ARC personnel as soon as possible after completion of the flight, it is necessary that two ARC personnel be aboard the prime recovery vessel. They will have with them a portable laboratory weighing approximately 70 pounds plus their personal gear. Facilities available to them aboard the primary recovery vessel must include use of necessary laboratory bench space, a sink with potable water, and a refrigerator for storing the biological material. These two personnel will board the primary recovery vessel at an appropriate time prior to the vessel's departure from the U.S. mainland.

4.5 Inflight Considerations

The remaining four operations for this experiment must be programed into the GT-3 flight plan. At the appropriate times the command astronaut will turn the experiment capsule handle to the right to the positive stop and release it. The handle returns to the start position automatically after each operation. The inflight schedule for these four operations is as follows:

Operation	Time	Action
*2	Launch plus 20(±5) min.	Fertilize chambers 5, 6, 7, and 8
3	Launch plus 20(±5) min.	Fix chambers 1 and 2
4	Launch plus 70(±5) min.	Fix chambers 3, 4, 5, and 6
5	Just before reentry	Fix chambers 7 and 8

*NOTE: Operation number 1 was performed prior to launch.

The command astronaut must record the spacecraft cabin temperature and the exact time that the above operations were performed. These temperatures and times must be reported to the first available ground station who will transmit them to Cape Kennedy. The MCC will relay them to the ARC launch site personnel who will perform the identical

operation on the ground control capsule. The ground control capsule environment will continue to be maintained as close as possible to the spacecraft cabin temperature. Upon completion of these four inflight operations, no further astronaut action is required for this experiment.

4.6 Postflight Considerations

4.6.1 Recovery area.- As soon as possible after recovery of the spacecraft, recovery personnel will gently remove the experiment capsule from the spacecraft hatch and deliver it to the ARC personnel on board the primary recovery vessel. The time of removal and the spacecraft environmental temperature should be recorded. The capsule should be placed in the handle-up position and no attempt should be made by recovery personnel to open it. Rough handling and exposure to extreme temperatures (below 36° F and above 90° F) should be avoided. If the spacecraft is recovered in a secondary or contingency area, thereby delaying delivery of the capsule to the ARC personnel, the capsule will be immediately stored in a handle-up position in a refrigerator until it can be delivered. Special precautions should be taken to insure that the capsule is not frozen. Immediately after receipt of the capsule, the ARC personnel will open the capsule, examine the embryos, and prepare the material for further laboratory work.

4.6.2 Launch site.- After completion of the flight, ARC personnel at Cape Kennedy will open the ground control capsule and prepare that material for further laboratory work. The ARC personnel will leave the launch site within 48 hours after completion of the GT-3 mission. Both the flight and ground control biological material will be examined for gross morphological aberrations and histological abnormalities. The data obtained will be compared and results will be made available to the NASA Gemini Program Office.

4.7 Installation Procedures

The experiment capsule has no spacecraft interface except mounting on the left-hand hatch. It is to be positioned in the holding bracket illustrated in figure 4-3.

4.8 Checkout Procedures

The experiment capsule will be delivered to NASA Cape Kennedy personnel in a sealed condition. Checkout procedures are not applicable.

4.9 Flight Qualification Requirements

The experiment capsule is the only spacecraft mounted equipment required for this experiment. The capsule must pass the following flight

qualification requirements in accordance with table 1 of the McDonnell Aircraft Corporation (MAC) Report Number 8433, "General Environmental Requirements for Model 133P".

4.9.1 Ambient temperature.- The integrity of the sealed capsule must be demonstrated at temperatures ranging from -15° F to +200° F.

4.9.2 Ambient pressure.- The integrity of the sealed capsule must be demonstrated at external pressures ranging from 23.5 psia to 10^{-12} psia.

4.9.3 Temperature-pressure.- The integrity of the sealed capsule must be demonstrated at a temperature of 200° F at 10^{-12} psia and ranging to 15.5 psia over a 10 minute period.

4.9.4 Shock.- The capsule must be ultimate shock tested in accordance with figure 9 of MAC Report 8433. Operation following the test is not required. However, the capsule shall not break loose from its mount and internal parts must be contained within the capsule envelope. The capsule shall be subjected to 6 landing impact shocks, one in each direction along each axis.

4.9.5 Acceleration.- The capsule shall be subjected to the following acceleration tests:

4.9.5.1 Longitudinal axis: Both directions from 1.0g to 7.25g linearly with time over 326 seconds.

4.9.5.2 All axes: All directions at 7.25g for a 1-second duration.

4.9.5.3 Longitudinal axis: Both directions at 15g for a 30-second duration.

4.9.5.4 Pitch and yaw axes: Both directions in each axis at 4.5g for a 30-second duration.

4.9.6 Vibration.- The capsule shall be subjected to the vibration tests outlined in paragraphs 4.15.1, 4.15.3, and 4.15.4; and figures 1 and 3 of MAC Report 8433.

4.9.7 Other tests.- Relative humidity, rain, salt sea atmosphere, sand and dust, fungus, oxygen atmosphere, acoustic noise, and radio interference tests are considered to be not applicable to this experiment. The possible exposure time of the capsule to any of these environments is so short that the probability of damage is essentially zero. The capsule is entirely a self-contained mechanical device and has no electrical,

magnetic, or radiation effect on any other spacecraft systems. At the GT-3 launch site, the capsule will be kept in a controlled atmosphere until time for installation into the spacecraft cabin section. It will be removed from the spacecraft as soon as possible after the flight has been completed.

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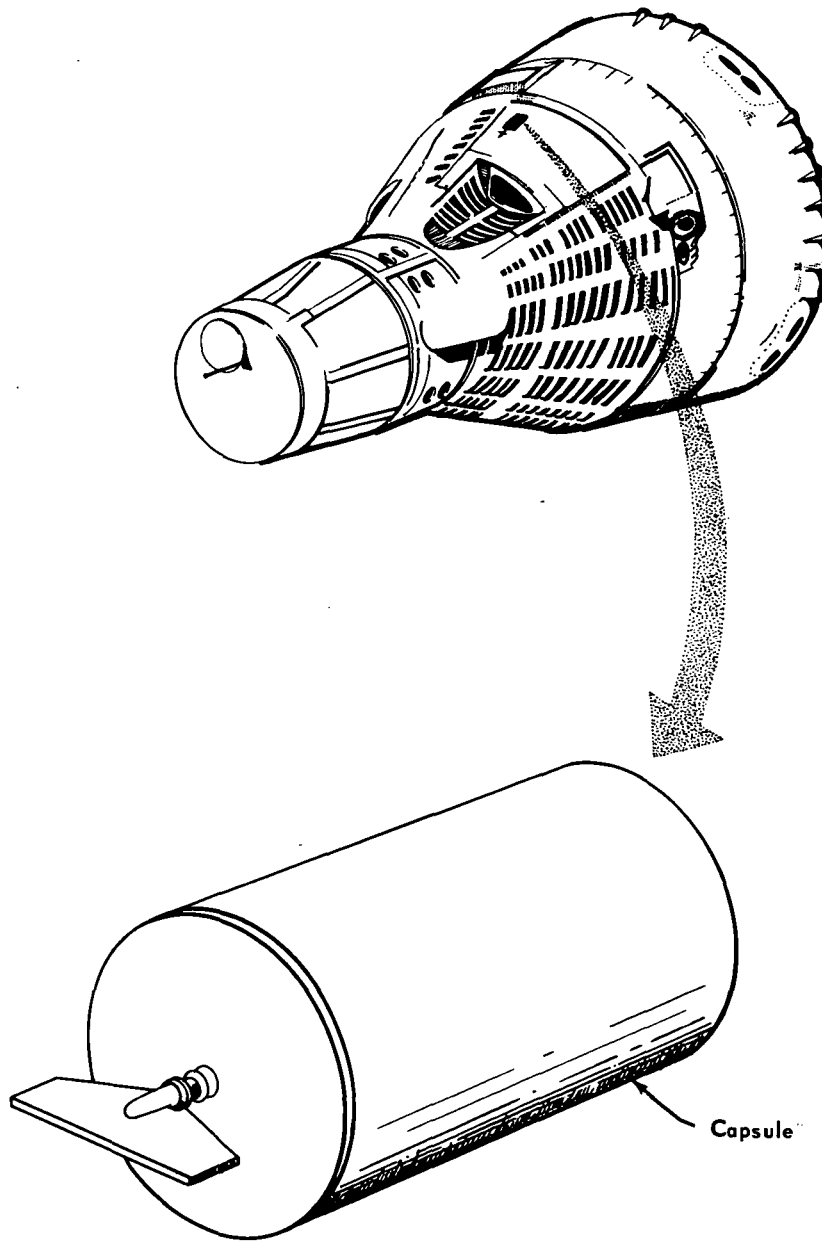

Figure 4-1.- Gemini spacecraft location of sea urchin eggs experiment.

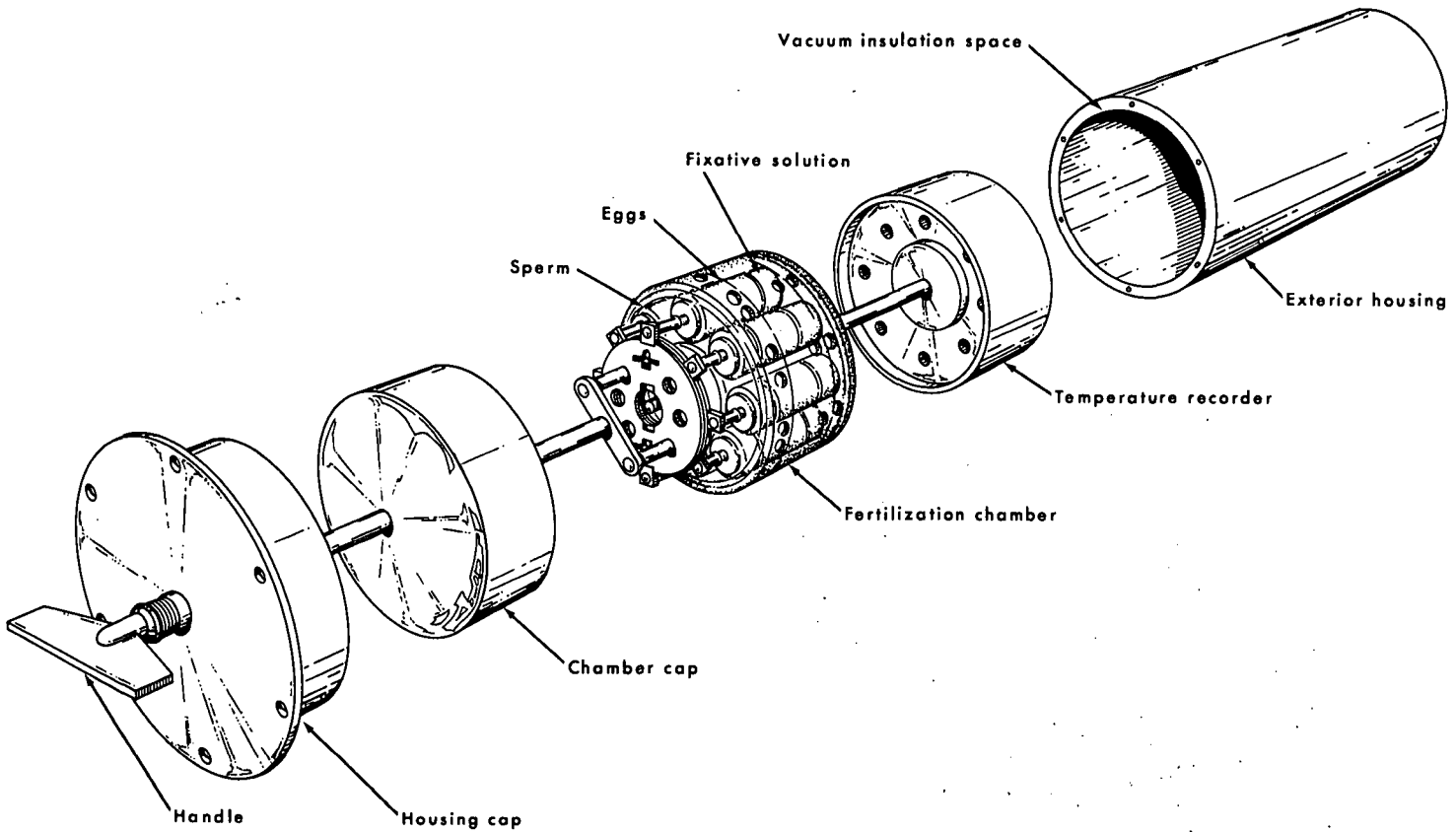

Figure 4-2.- Sea urchin eggs experiment capsule.

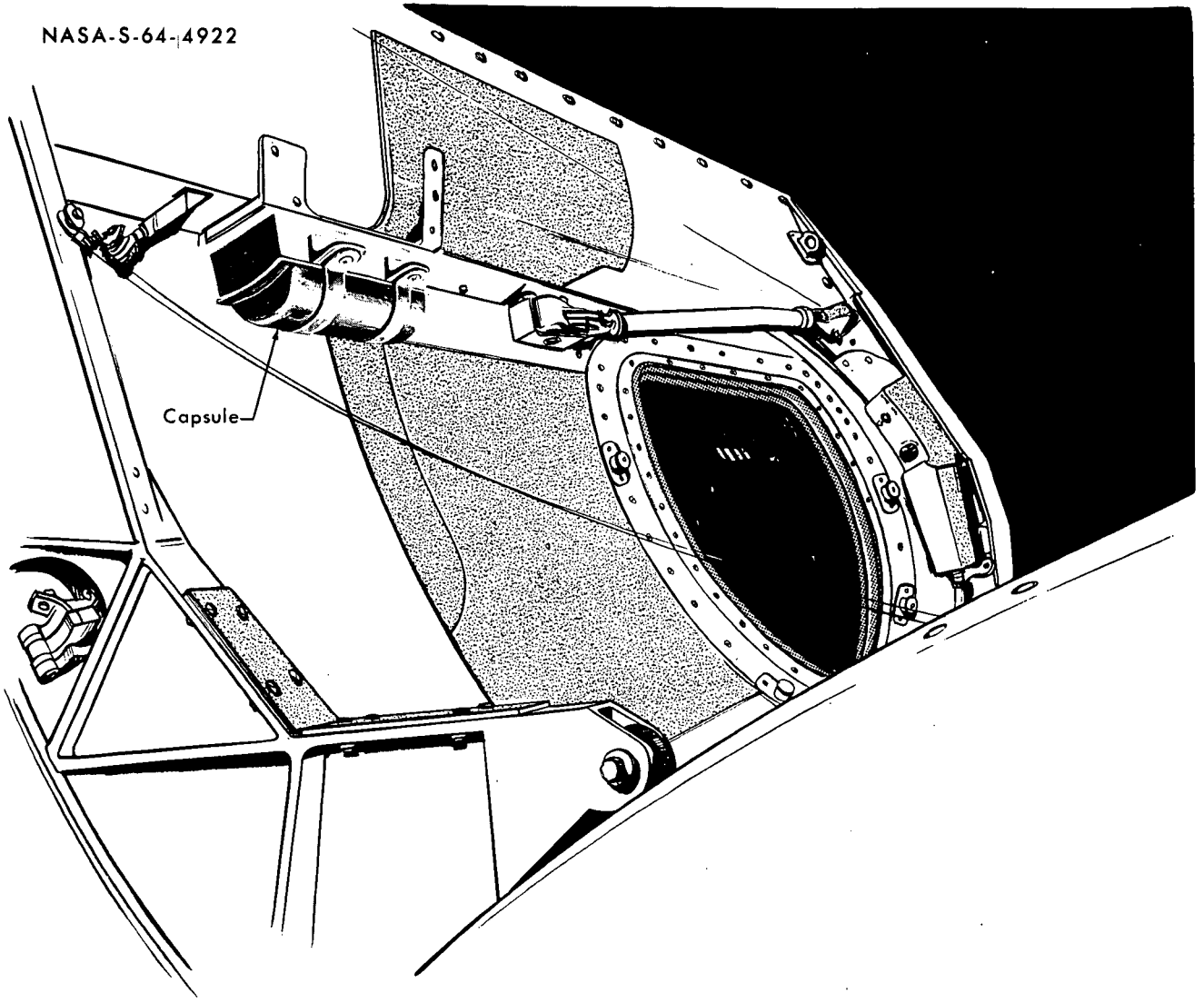

Figure 4-3.- Installation of sea urchin eggs experiment capsule in GT-3 spacecraft left-hand hatch.

5.0 EXPERIMENT NUMBER S-4 (POISE 74) - SYNERGISTIC EFFECT OF ZERO GRAVITY AND RADIATION ON WHITE BLOOD CELLS

5.1 Justification

Certain biological effects usually associated with radiation damage have been observed after ballistic and orbital space flights. In a number of cases, the effects noted were greater than would have been predicted for the radiation exposure received during the flight. This phenomenon is of special concern to manned spaceflight programs because of the possible radiation exposure during prolonged space flights. An unpredicted radiation effect could be due to either or both of two factors. The "heavy primaries" component of the radiation encountered above the earth's atmosphere is not available for test use in terrestrial laboratories. The possibility exists that these particles have unexpected biological effects. The other possibility is that environmental parameters of space flight, such as prolonged weightlessness, interact synergistically with radiation to produce unpredicted effects. This experiment was designed for the GT-3 mission to test these possibilities of space radiation exposure. It will be conducted by the Atomic Energy Commission (AEC), Oak Ridge, Tennessee, and is sponsored by the NASA Office of Space Sciences (OSS), Washington, D.C.

5.2 Scope

This experiment will measure the frequencies of various types of chromosomal aberrations in a series of whole, heparinized, human blood samples exposed to a known quantity and quality of ionizing radiation during the zero gravity phase of the GT-3 mission. For comparison purposes, a similar series of control samples will be exposed simultaneously on the ground. An analysis will also be made on blood samples taken from the GT-3 astronauts immediately before and after completion of the mission. If no unusual effects are detected by this experiment, additional experiments on future flights will not be required. However, if significant unpredicted results are obtained, further ground-based or inflight experiments might be desirable. The exact number and extent of such future experiments will be dictated by the results of this GT-3 experiment.

5.3 Description

5.3.1 Operation.- This experiment consists of a metal device containing two sets of five, 3-milliliter heparinized samples of freshly drawn, sterile human blood. The experiment device and its Gemini spacecraft location are shown in figure 5-1. The samples will be derived from two normal, pretested donors. One sample from each donor will be used

for comparison purposes as an unirradiated flight control. The remaining four samples from one donor will be paired with those of the other, and each pair of samples will receive a different dose of beta radiation during the flight. The radiation will be supplied by plaques of Phosphorous-32 (P^{32}), an isotope which emits only a single beta particle with an average energy of 0.7 mev. Because of the beta particles short range, the blood samples are in the form of 3 mm thick discs interposed between pairs of P^{32} sources. This arrangement will provide a reasonably homogeneous radiation dose to the entire sample volume. All four radiation doses will be given simultaneously in a nominal 20-minute period starting at least 1 hour after the beginning of orbital flight, and ending at least 1 hour before the reentry phase of the mission. The different radiation doses will be made primarily by providing P^{32} sources of differing activities. The final dose adjustment will be calculated from the known activity of the sources, the half-life of P^{32}, and the time of GT-3 launch. Built-in dosimeters will provide an additional measure of the absorbed dose actually received.

5.3.2 Equipment.- The experiment material is housed in a device known as Blood-In-Gemini model 1 (BIG-1) and is illustrated in figure 5-2. This device is a hermetically sealed aluminum box approximately 3.7 inches wide, 1.3 inches deep, 3.8 inches long, has a 3.2 inch long operating handle with 1.6 inches of travel and weighs approximately 1 pound. This box contains the blood sample holders, P^{32} sources, fluoroglass dosimeters, and the instrument package. The BIG-1 outer shell absorbs stray radiation from the P^{32} sources and protects the blood samples from environmental conditions unfavorable to the experiment.

The BIG-1 instrument package (see figure 5-3) provides both a time-temperature and a time-activation record. Time is measured by two microcoulometers driven by mercury batteries at a rate which provides approximately 30 hours of running time with a resolution of about one-half hour. Temperature and activation time records are recorded by colored lights on photographic film. Two separate film and light-pipe assemblies provide record redundancy. Temperature detection is provided by six thermostatic switches which control four colored lamps. Activation detection is provided by an event marker switch and one colored lamp. These lamps operate from 1.35 volt mercury batteries. The instrument package is completely self-contained and is potted in opaque epoxy resin.

Irradiation of the blood samples is to be initiated manually during the flight by twisting the operating handle counterclockwise to unlock the mechanism and pushing the handle into the "activate" position. A twist of the operating handle clockwise locks the device in the irradiate

state. This action interposes the blood samples between the pairs of P^{32} radiation sources. When the appropriate irradiation time of 20 minutes has elapsed, the operating handle is unlocked (by turning counterclockwise) and pulled out to the deactivate position. An additional clockwise twist of the operating handle locks the device in the non-irradiate state. This action withdraws the blood samples from between the P^{32} sources and terminates the irradiation. A duplicate BIG-1 device will be activated and deactivated simultaneously on the ground at the GT-3 launch site. The ground control device will be subjected to a temperature profile similar to that experienced by the flight device during the flight. Information from the ground device will provide control data to compare with that obtained from the flight experiment.

5.4 Preflight Considerations

5.4.1 Launch site.- In order for data from this experiment to be useful, the blood samples must be obtained from the donors as close as possible to the launch time of the GT-3 vehicle. The blood must be kept sterile and must be recovered for further processing within approximately 24 hours after it is drawn. It cannot be allowed to freeze, nor can its temperature be allowed to exceed 104° F. For these reasons, all preflight preparation, assembly, and testing of the flight device must be performed as close as possible to the GT-3 launch site. These activities will be performed in a 10-foot by 40-foot mobile laboratory parked as near as is feasible to Complex 19 at Cape Kennedy. The mobile laboratory and four AEC personnel will arrive at Cape Kennedy approximately 10 days before the scheduled launch date. The mobile laboratory will be located, utility connections made, and all necessary equipment checked out. Liaison will be established with appropriate NASA and Cape Kennedy personnel. An additional two AEC personnel will arrive at Cape Kennedy approximately 5 days before the scheduled launch date. These two personnel will bring the P^{32} radiation sources with them. Six hours before the scheduled launch time, NASA medical personnel will draw blood samples from two predesignated AEC personnel using AEC equipment. The blood samples will be prepared and the BIG-1 flight and ground control devices will be assembled, sealed, and tested by AEC personnel. The flight device will be delivered to predesignated NASA personnel for installation into the spacecraft. The time of installation must be programed into the GT-3 countdown procedures approximately 120 minutes or less before the scheduled launch time. Reasonable gentle handling and protection from freezing or extremely high temperatures is required for the device. The device will be inserted in and secured to the mounting bracket on the right-hand hatch of the spacecraft as illustrated in figure 5-4. No other interface with any spacecraft system is required. In addition to the BIG-1 ground control and flight experiment blood samples, blood samples

from the GT-3 astronauts will also be processed and tested. The blood required for this experiment does not represent an additional sample of blood from the astronauts. NASA medical personnel will draw their routine preflight blood samples from both astronauts 4 or 5 days prior to the scheduled launch date. Ten milliliters of each blood sample will be used for obtaining white blood cells, leaving the plasma and red blood cells for other chemical analysis by NASA personnel. No additional facilities, personnel, or equipment will be required. The astronaut preflight blood samples will be processed in the launch site mobile laboratory by AEC personnel.

5.4.2 Recovery areas.- Due to the requirement for recovery of the device by AEC personnel within 24 hours after the blood is drawn from the donors, it is necessary that one AEC representative be present in the primary and in each of two secondary recovery areas. Each of these three personnel will be aboard the primary recovery vessel for his area. Each of these personnel will have a portable laboratory in three cases weighing a total of approximately 100 pounds plus his personal gear. Their activities aboard the recovery ships will require the use of laboratory bench space and a sink with potable water, preferably in the ship's medical facility. Each of these personnel will board the appropriate recovery vessel at an appropriate time prior to the vessel's departure from the U.S. mainland.

5.5 Inflight Considerations

During GT-3 launch, orbital insertion, and first orbit, the BIG-1 flight device in the spacecraft cabin and the ground control device in the mobile laboratory will remain in the non-irradiated state. The environment of the ground control device will be maintained at a temperature as near as possible to that of the spacecraft cabin. The activation of the device must be programed into the GT-3 flight plan. At least 20 minutes before completion of the second orbit, the Second Astronaut will activate the flight device by twisting the handle counterclockwise to unlock, pushing the handle into the activate position and twisting the handle clockwise to lock the device in the activation position. The astronaut must give verification in real time of activation and locking. When the mobile laboratory personnel receive verification that the flight device has been activated, the ground control device will be activated. At the end of the 20(±1) minute irradiation interval, the Second Astronaut will deactivate the flight device by twisting the handle counterclockwise to unlock, pulling the handle out to the deactivate position, and twisting the handle clockwise to lock the device in the deactivated position. The astronaut must give verification in real time of deactivation and locking. When the mobile laboratory personel receive verification that the flight device has been deactivated, the ground control device will be deactivated. During the third orbit

and reentry, the flight device and ground control device will remain in the non-irradiated state. No further astronaut action is required for this experiment. The Mission Control Center (MCC) must insure that the real time activation and deactivation flight device verifications from the astronaut are relayed immediately to the AEC personnel at the mobile laboratory. Data regarding spacecraft cabin temperatures during the flight must also be available to the mobile laboratory.

5.6 Postflight Considerations

5.6.1 Recovery areas.- As soon as possible after recovery of the spacecraft, recovery personnel will remove the BIG-1 flight device from the spacecraft hatch and deliver it to the AEC personnel on-board the primary recovery vessel for that area. Immediately after receipt of the device, the AEC personnel will open the device and place the blood samples into tissue cultures. The dosimeters and instrument package will be carefully stored for later reading at AEC facilities. Recovery vessel medical personnel will draw their routine postflight blood samples from both astronauts during the medical examination immediately after recovery. Ten milliliters of each sample will be used to obtain white blood cells as in the preflight sample. The astronaut postflight blood samples will be placed into tissue cultures the same as the BIG-1 device blood samples. Three days after preparation of the tissue cultures, the cultures will be terminated and the material prepared for return to AEC facilities.

5.6.2 Launch site.- As soon as notification of spacecraft recovery is received at the launch site mobile laboratory, the ground control device will be opened and these and the preflight astronauts blood samples placed into tissue cultures. Three days after recovery, the blood cultures will be terminated and the material prepared for return to the AEC. The mobile laboratory and all launch site AEC personnel will leave Cape Kennedy on the fourth day after recovery of the spacecraft. After the flight blood samples have been returned to the AEC Oak Ridge National Laboratory Biology Division, they will be scored for chromosomal aberrations and compared to the ground control samples. After all control and experimental data have been thoroughly analyzed, the results will be made available to the NASA Gemini Program Office.

5.7 Installation Procedures

The BIG-1 flight device has no spacecraft interface except mounting on the right-hand hatch. It is to be positioned in the holding bracket illustrated in figure 5-4.

5.8 Checkout Procedures

The BIG-1 flight device will be delivered to NASA Cape Kennedy personnel in a sealed condition. Checkout procedures are not applicable.

5.9 Flight Qualification Requirements

The BIG-1 device is the only spacecraft mounted equipment required for this experiment. The device must pass the following flight qualification requirements in accordance with table 1 of the McDonnell Aircraft Corporation (MAC) Report Number 8433, "General Environmental Requirements for Model 133P".

5.9.1 Ambient temperature.- The integrity of the sealed device must be demonstrated at temperatures ranging from -15° F to +200° F.

5.9.2 Ambient pressure.- The integrity of the sealed device must be demonstrated at external pressures ranging from 23.5 psia to 10^{-12} psia.

5.9.3 Temperature-pressure.- The integrity of the sealed device must be demonstrated at a temperature of 200° F at 10^{-12} psia and ranging to 15.5 psia over a 10 minute period.

5.9.4 Oxygen Atmosphere.- The device shall operate properly in a 100 percent oxygen atmosphere at pressures ranging from 15.5 psia to 6.0 psia and at temperatures to 160° F. The device shall not demonstrate any visible burning, creation of toxic gases, obnoxious odors, or deterioration of any of its components.

5.9.5 Shock.- The device must be ultimate shock tested in accordance with figure 9 of MAC Report 8433. Operation following the test is not required. However, the device shall not break loose from its mount and internal parts must be contained within the device envelope. The device shall be subjected to 6 landing impact shocks, one in each direction along each axis.

5.9.6 Acceleration.- The device shall be subjected to the following acceleration tests.

5.9.6.1 Longitudinal axis: Both directions from 1.0g to 7.25g linearly with time over 326 seconds.

5.9.6.2 All axes: All directions at 7.25g for a 1-second duration.

5.9.6.3 Longitudinal axis: Both directions at 15g for a 30-second duration.

5.9.6.4 Pitch and yaw axes: Both directions in each axis at 4.5g for a 30-second duration.

5.9.7 Vibration.- The device shall be subjected to the vibration tests outlined in paragraphs 4.15.1, 4.15.3, 4.15.4, and figures 1 and 3 of MAC Report 8433.

5.9.8 Radio interference.- The device shall be tested for radio interference in accordance with Military Specification MIL-I-26600. The device should present no radio interference to spacecraft systems since all associated electrical circuits, including power supplies, are completely enclosed in the metal case. Currents of less than 10 milliamperes to a resistive load are switched by snap action miniature thermostats.

5.9.9 Exterior radiation.- Exterior radiation levels will be measured just prior to flight on each face of the sealed device. They will not present a hazard to the astronauts or the spacecraft systems.

5.9.10 Other tests.- Relative humidity, rain, salt sea atmosphere, sand and dust, fungus, and acoustic noise tests are considered to be not applicable to this experiment. The possible exposure time of the device to any of these environments is so short that the probability of damage is essentially zero. The device is entirely self-contained and has no effect on any other spacecraft system. At the GT-3 launch site, the BIG-1 flight device will be kept in the mobile laboratory in a controlled atmosphere until time for installation into the spacecraft cabin section. It will be removed from the spacecraft immediately after the flight has been completed. During final assembly, the device is sealed and vacuum tested for leaks. The exterior materials of the device and stainless steel, brass, aluminum, and chromium-plated drill rod.

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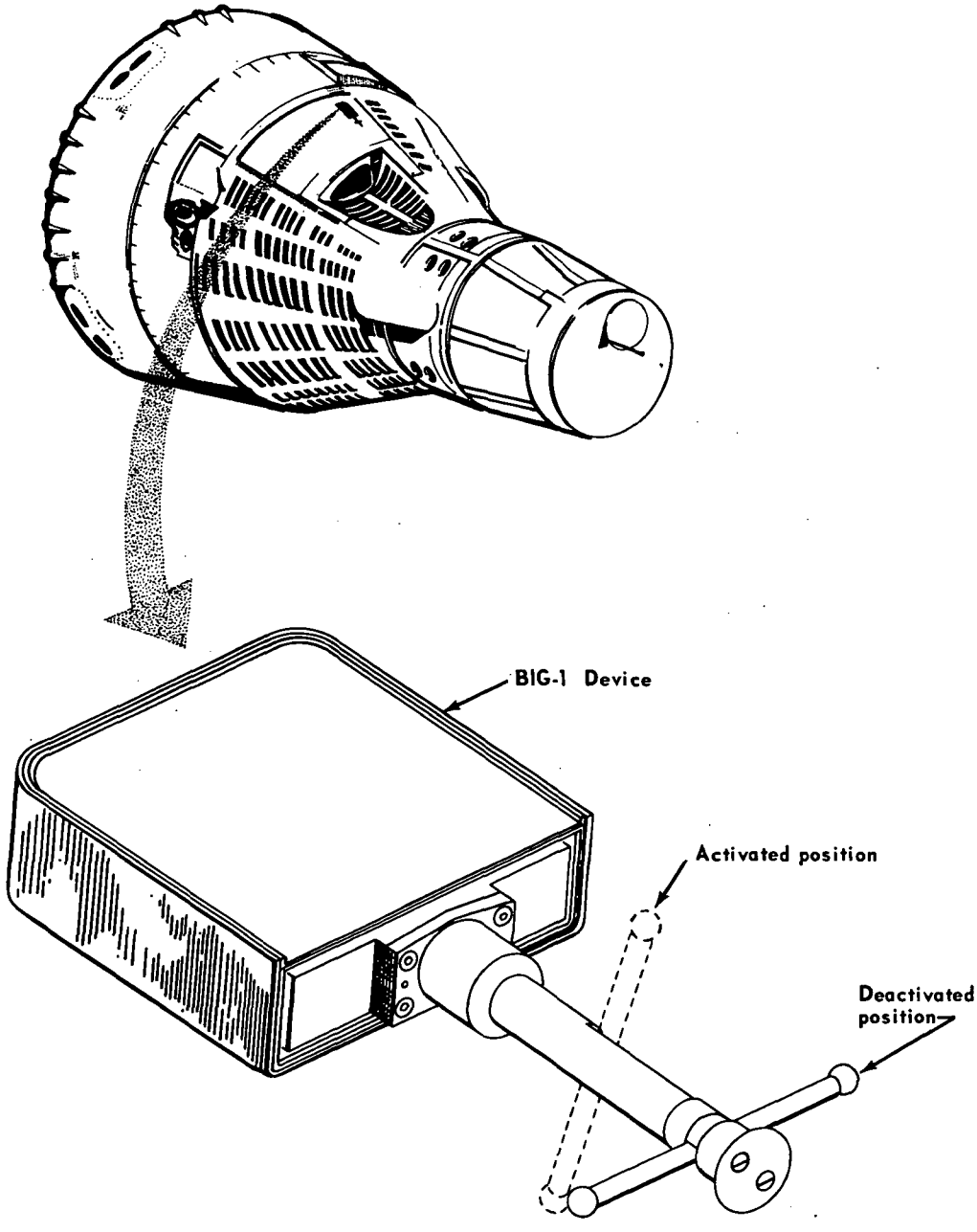

Figure 5-1.- Gemini spacecraft location of white blood cells experiment.

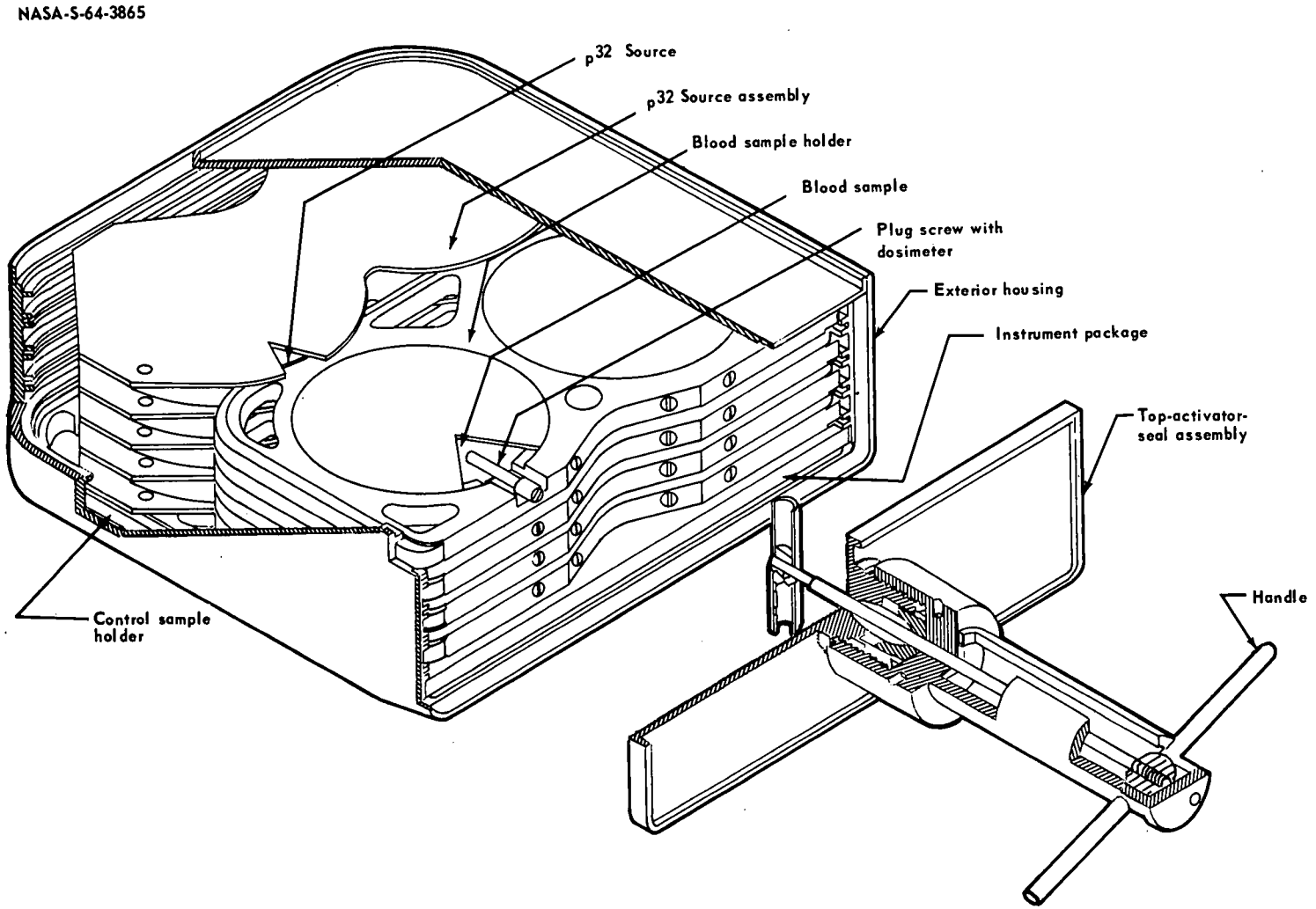

Figure 5-2.- White blood cells experiment BIG-1 device

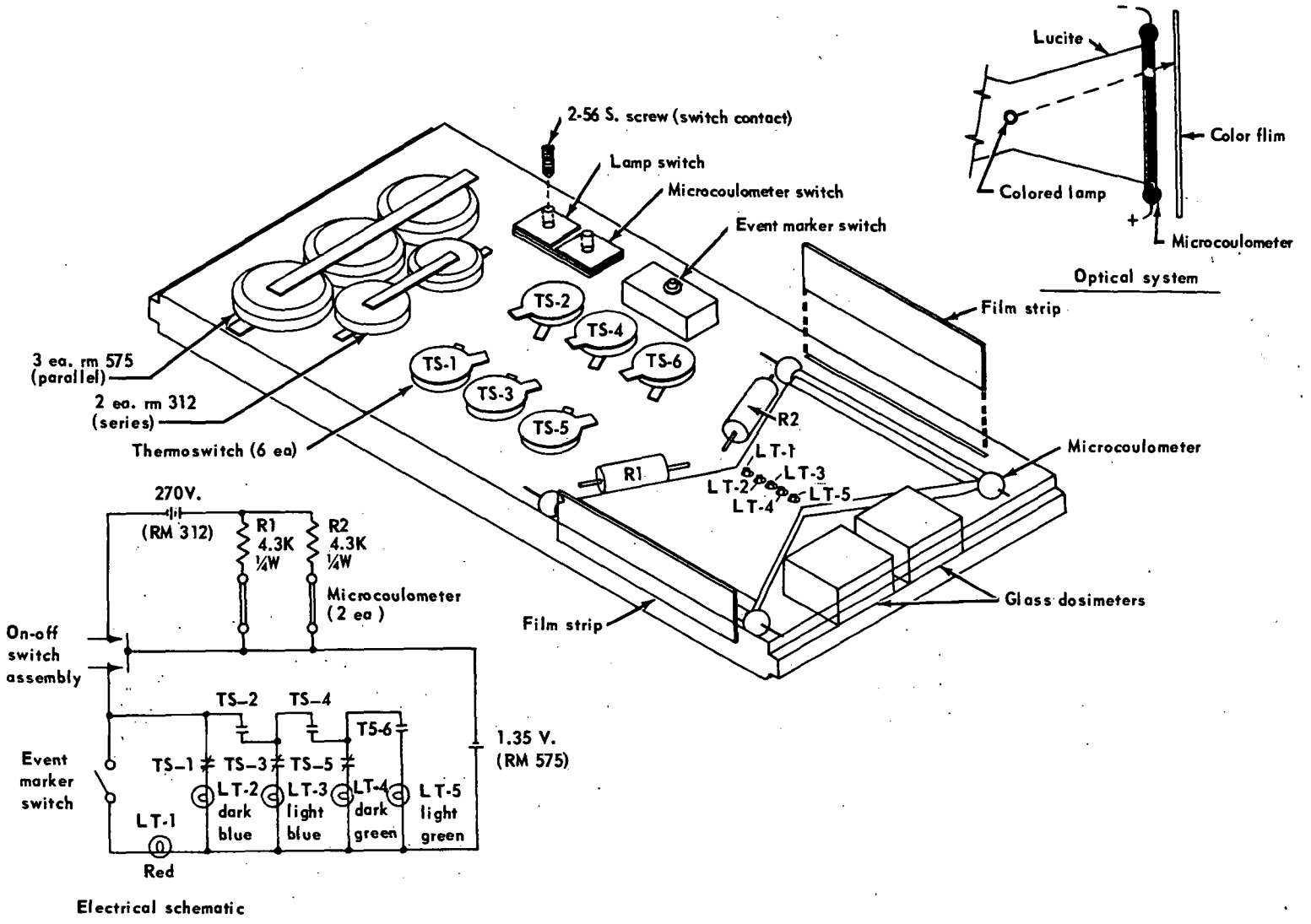

Figure 5-3.- BIG-1 device instrument package and schematic.

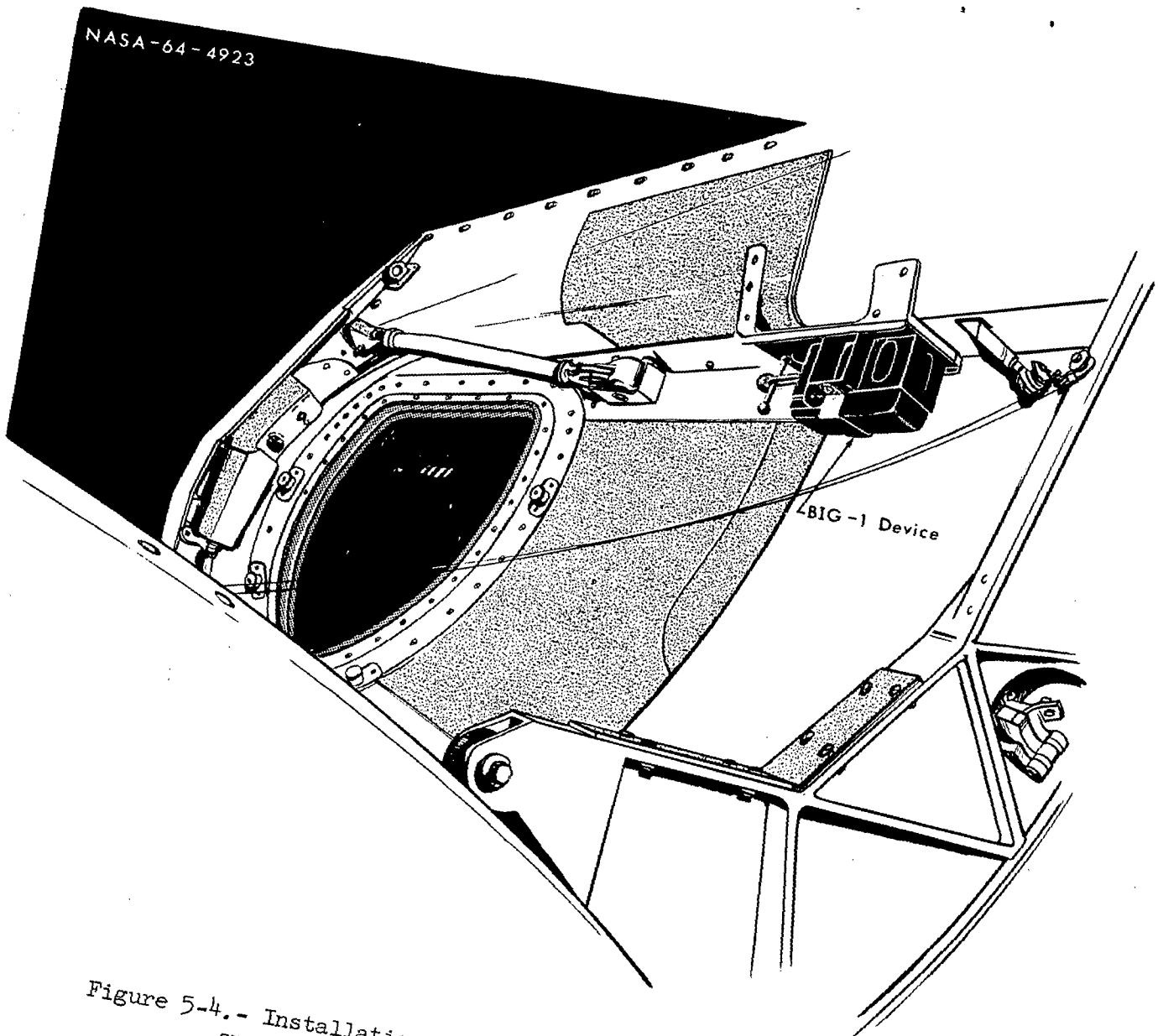

Figure 5-4.- Installation of BIG-1 device in GT-3 spacecraft right-hand hatch.

6.0 EXPERIMENT NUMBER T-1 (POISE 3) - REENTRY COMMUNICATIONS

6.1 Justification

An object reentering the earth's atmosphere from space is subjected to extremely high temperatures. These temperatures ionize the plasma sheath surrounding the object and effectively eliminate radio communications with it. All Project Mercury manned space flights experienced this phenomenon and suffered loss of all telemetry and voice communications during a portion of the critical reentry phase of the flight. This loss of signal period is known as reentry blackout.

Experimental research has developed a material additive method for restoring radio communications during the reentry blackout period. This technique has been successfully verified for objects with a maximum nose diameter of 8 inches and at velocities up to approximately 18,000 feet per second.

This experiment is designed to extend this technique to a large, blunt, high-velocity vehicle such as is used in the Gemini Program. The development of a method to obtain successful reentry communications with moderate weight requirements will be extremely valuable for future manned space flights. This experiment was designed for the GT-3 mission by the NASA Langley Research Center, Hampton, Virginia. It is sponsored by the NASA Office of Advanced Research and Technology (OART), Washington, D.C.

6.2 Scope

This experiment will further evaluate the technique of injecting a fluid material into the flow field around an object to restore radio communications during reentry blackout. Researth studies have shown that radio frequency wave propagation in an ionized plasma will occur when the radio frequency is of a higher value than the frequency of the plasma. It has also been determined that injecting certain types of fluid into the ionized plasma will decrease the amount of ionization to a level where radio wave propagation will occur and permit communications through the plasma.

For this experiment, pure water will be the injection material and the GT-3 spacecraft will be the test vehicle. The water will be injected in timed pulses at different flow rates into the ionized plasma sheath formed around the GT-3 spacecraft during reentry. Figure 6-1 is an illustration of how the reentry ionized plasma sheath is reduced by injecting

a fluid into the spacecraft flow field. The water should lower the frequency of the ionized plasma enough to permit ultra high frequency (UHF) radio communications. The ground stations will receive sporadic UHF signals in phase with the timed water injections. Signal levels received will be monitored and recorded for use in evaluating the effectiveness of the different flow rates. Data obtained will demonstrate the feasibility of this type of reentry communications technique and help to establish additive material requirements. This experiment is part of a continuing study into methods of overcoming the reentry communications blackout.

6.3 Description

6.3.1 Equipment.- This experiment consists of a water expulsion system designed to fit on the inside surface of the GT-3 spacecraft right main landing gear door. Figure 6-2 indicates the experiment location on the spacecraft, and figure 6-3 illustrates the equipment installation on the inside of the right main landing gear door. The system is completely self-contained on the gear door except for the experiment activation switch located inside the spacecraft cabin. This switch is installed on the right switch/circuit breaker panel and is placarded RE-ENT ANT EXP. The panel location of the switch is illustrated in figure 6-4. Except for the electrical connection between the activation switch and the gear door equipment, there is no interface with any other spacecraft equipment or system.

A list of the experiment's major components and their function and operation is given in table 6-1. Total weight of the equipment serviced for flight is approximately 70 pounds.

6.3.2 Operation.- As the GT-3 spacecraft reenters the earth's atmosphere on the descent from orbital altitudes, the communications blackout period will commence at approximately 300,000 feet. The Second Astronaut will be looking through his window to observe the start of this period. When the ionized plasma sheath has formed around the spacecraft and the reentry communications blackout period has started, the Second Astronaut will place the experiment activation switch in the ON position and record the time. Actuation of the switch will open the solenoid shut-off valve and allow pressurization of the water storage tank. It will also activate and start operation of the mechanically-run injection sequence timer. The timer will activate the injection nozzle solenoid valves at their programed times to allow injection of the water into the spacecraft flow field. Injection of the water will continue for approximately 150 seconds at which time the water supply will be exhausted. The flow diagram for the nitrogen gas and the water is detailed in figure 6-5. The electrical schematic is given in figure 6-6 and the electrical wiring diagram is presented in figure 6-7.

6.3.3 Results.- During the period of operation of this experiment, brief UHF radio communications with ground stations may be established each time a water injection is made. Stations within communications range of the spacecraft will monitor and record the strength of the signals and the time they were received. These data will be used in the postflight experiment evaluation to help determine the most efficient quantities and flow rates of the additive material.

6.4 Preflight Considerations

6.4.1 Equipment.- The experiment equipment must be serviced for flight after the GT-3 spacecraft has been delivered to Cape Kennedy. This preparation consists of charging the nitrogen pressure tank with approximately 3,000 psig of nitrogen gas, filling the water storage tank and lines with water, and installing a fresh battery.

The right main landing gear door already installed on the spacecraft will be removed and replaced with another door that has had the experiment equipment serviced for flight. Exchange of these spacecraft doors will be made at a convenient time as close as possible to launch. The time of the door exchange and subsequent equipment checkouts must be programed into the GT-3 countdown procedures.

If the exchange of gear doors is made well in advance of the scheduled launch data, a check should be made once every 5 days to insure that the experiment equipment is still in a flight-ready status. In any event, a final equipment check should be made within 6 hours of launch. This check consists of measuring the battery voltage and making a readout of the pressure transducer to obtain nitrogen gas pressure. These measurements will be made by attaching suitable instruments to the proper arming receptacle terminals. After the final preflight check has been completed, the arming plug will be inserted in the receptacle to arm the experiment. The plate provided to cover the access to the arming receptacle will then be installed on the outer skin of the spacecraft. If the GT-3 launch does not occur within three weeks of the date the experiment equipment was initially serviced for flight, the landing gear door will be removed, the equipment again serviced for flight, and the gear door reinstalled on the spacecraft. Personnel from the NASA Langley Research Center will service the equipment for flight and monitor all other preflight checkouts and installations of this experiment.

6.4.2 Personnel.- Four personnel representing the NASA Langley Research Center will arrive at Cape Kennedy at a time appropriate for the installation of the experiment equipment and gear door on the spacecraft. They will bring the flight qualified equipment and gear door with them and will service it for flight. They will also bring all necessary hand tools, checkout meters and instruments, and the water supply to be used in

the experiment. It will be necessary that they have access to a 3,000 (±25) psig nitrogen gas supply and a 110 volt, 60 cycle, single-phase electrical power source at Cape Kennedy to enable them to service the experiment equipment.

Due to the importance of obtaining accurate data during the conduct of this experiment, it is desirable that one NASA Langley Research Center personnel be present at each communications station that can be expected to receive spacecraft signals during the reentry blackout period of the GT-3 mission. These will include but not be limited to the following locations: Eglin Air Force Base, Florida; Cape Kennedy, Florida; Grand Bahama Island; Grand Turk Island, and primary recovery ships with a UHF reception capability. These personnel will observe the reception of and recording of any signals received during the course of this experiment. A copy of the signal strengths recorded and the station equipment calibration data will be required from each such station.

6.5 Inflight Considerations

6.5.1 Spacecraft.- Within ±15 seconds after the ionized plasma sheath has formed around the spacecraft to start the reentry blackout period (300,000 feet altitude), the Second Astronaut will place the experiment activation switch in the ON position and note the time. No further astronaut action is required for the successful operation of this experiment. The experiment water supply will be exhausted in approximately 150 seconds. If desired, the experiment activation switch can be placed in the OFF position anytime after 400 seconds from the initial activation of the experiment. This will remove the electrical power from the experiment equipment components.

6.5.2 Ground telemetry stations.- Ground communication stations will record the signal levels received from the spacecraft during the course of this experiment. A copy of these data and the individual station equipment calibration data will be furnished to the NASA Langley Research Center for postflight analysis.

6.6 Postflight Considerations

6.6.1 Equipment.- At some convenient time after recovery of the spacecraft, the right main landing gear door containing the experiment equipment should be returned to the NASA Langley Research Center.

6.6.2 Personnel.- The NASA Langley Research Center personnel at Cape Kennedy and other communication stations will leave their respective locations as soon as it is convenient after completion of the GT-3 flight. A copy of the data obtained by the ground stations will be furnished to

the NASA Langley Research Center for analysis. After thorough analysis, the results of this experiment will be provided to the NASA Gemini Program Office.

6.7 Installation Procedures

The experiment equipment will be installed on the GT-3 spacecraft right main landing gear door by personnel from the NASA Langley Research Center. The McDonnell Aircraft Corporation (MAC) will install the experiment activation switch on the right-hand panel located in the cabin section. At a convenient time in the GT-3 preparation period, the flight door and equipment will be installed on the spacecraft by appropriate NASA and MAC personnel. When this installation is made, the electrical connection at connector J4 will be completed between the activation switch and the gear door equipment. This experiment has no other interface with any spacecraft system.

6.8 Checkout Procedures

6.8.1 Installation.- After the experiment equipment has been installed on the right main landing gear door, the electrical system must be checked for continuity to insure that it is wired in accordance with figures 6-6 and 6-7. The complete electrical system must be measured with a 500 volt Megger, conductor to conductor, and each conductor to ground. The conductor insulation resistance must not be less than 100 megohms. In addition, the tests of table 6-2 will be made with arming plug P2 removed from connector J2. Appropriate instruments will be used to conduct the tests and the values obtained will be recorded.

6.9 Flight Qualification Requirements

The experiment equipment mounted on the right main landing gear door and the activation switch in the cabin section are the only spacecraft mounted equipment required for this experiment. The equipment must pass the following flight qualification requirements in accordance with table II of the McDonnell Aircraft Corporation (MAC) Report Number 8433, "General Environmental Requirements for Model 133P".

6.9.1 Ambient temperature.- The integrity of the equipment assembly must be demonstrated at temperatures ranging from -60° F to +200° F.

6.9.2 Ambient pressure.- The integrity of the equipment assembly must be demonstrated at external pressures ranging from 15.5 psia to 10^{-12} psia.

6.9.3 Temperature-pressure.- The integrity of the equipment assembly must be demonstrated at a temperature of 200° F at 10^{-12} psia and ranging to 15.5 psia over a 10 minute period.

6.9.4 Shock.- The equipment assembly must be ultimate shock tested to a 40g level for a duration of 11 milliseconds. The longitudinal axis shall be tested with a 40° total cone angle. The lateral axes shall be tested in all directions. Operation following the test is not required. However, the equipment shall not break loose from its mount and internal parts must be contained within the equipment envelope. The equipment shall be subjected to 6 landing impact shocks, one in each direction along each axis.

6.9.5 Acceleration.- The equipment assembly shall be subjected to the following acceleration tests:

6.9.5.1 Longitudinal axis: Both directions from 1.0g to 7.25g linearly with time over 326 seconds.

6.9.5.2 All axes: All directions at 7.25g for a 1-second duration.

6.9.5.3 Longitudinal axis: Both directions at 15g for a 30-second duration.

6.9.5.4 Pitch and yaw axes: Both directions in each axis at 4.5g for a 30-second duration.

6.9.6 Vibration.- The equipment assembly shall be subjected to the vibration tests outlined in paragraphs 4.15.1, 4.15.3, and 4.15.4; and figures 2 and 3 of MAC Report 8433.

6.9.7 Other tests.- Relative humidity, rain, salt sea atmosphere, sand and dust, fungus, acoustic noise, and radio interference tests are considered to be not applicable to this experiment. The possible exposure time of the equipment to any of these environment before operation of the experiment is so short that probability of damage is essentially zero.

TABLE 6-1.- LIST OF EQUIPMENT MAJOR COMPONENTS AND FUNCTIONS

Major component	Function and operation
Water storage tank	Store water for injection into the flow field around the GT-3 spacecraft.
Nitrogen pressure tank	Store high pressure nitrogen gas used to expel the water from the water storage tank.
Nitrogen pressure regulator and solenoid shutoff valve	The solenoid shut-off valve is actuated by operation of the experiment activation switch to release nitrogen pressure to the water storage tank. The nitrogen pressure regulator serves to reduce the nitrogen gas pressure from approximately 3,000 to 300 psig.
Injection sequence timer	Actuated by operation of the experiment activation switch. Serves to time the water injection sequence and program the operation of the injection nozzle solenoid valves.
Injection nozzle solenoid valve (3 each)	Actuated by the injection sequence timer to release water through the injection nozzles.
Nitrogen charging valve	Serves to charge the nitrogen pressure tank with approximately 3,000 psig of nitrogen gas.
Nitrogen high pressure relief valve	Serves as a safety device to relieve excess nitrogen gas pressure on the high pressure side of the pressure regulator.
Nitrogen low pressure relief valve	Serves as a safety device to relieve excess nitrogen gas pressure on the low pressure side of the pressure regulator.
Water charging valve	Used to fill the water storage tank and lines with water.
Water charging bleed valve	Used to bleed air from the water storage tank and water lines during the filling operation.

TABLE 6-1.- LIST OF EQUIPMENT MAJOR COMPONENTS AND FUNCTIONS - Concluded.

Major component	Function and operation
Water pressure relief valve	Serves as a safety device for the water injection system after the water storage tank has been pressurized with nitrogen gas.
Experiment activation switch	Activates the experiment by electrical actuation of the solenoid shutoff valve and the injection sequence timer.
Arming receptacle	Provides a positive means of insuring the experiment is inoperative until the arming plug is installed prior to launch. Serves as a check point to test the battery voltage and check the nitrogen tank pressure by readout of the pressure transducer.
Arming plug	Inserted into the arming receptacle prior to launch to arm the experiment.
Battery	Provides an independent source of electrical power to operate the experiment.
Nitrogen pressure transducer	By readout through the arming receptacle, provides a means of checking the nitrogen tank pressure prior to launch.

TABLE 6-2.- EQUIPMENT PREFLIGHT CHECKOUT TESTS

No.	Connector J2 test points pin to pin		Test procedure
1	C	U	Measure resistance of pressure regulator solenoid.
2	F	U	Measure resistance of starting solenoid C1 for timer T2.
3	J	U	Measure resistance of valve V1 coil.
4	S	U	Measure resistance of valve V2 coil.
5	P	U	Measure resistance of valve V3 coil.
6			With timer T2 reset, use an ohmeter to determine contact positions.
7	D	H	Check for closed circuit contacts T2-S1 valve V1.
8	D	S	Check for open circuit contacts T2-S2 to valve V2.
9	D	P	Check for open circuit contacts T2-S3 to valve V3.
10	E	B	Check for open circuit contacts on activation switch AS-1.

TABLE 6-3.- EQUIPMENT COUNTDOWN CHECKOUT TESTS

No.	Connector J2 test points pin to pin		Test procedure
1	A	U	Measure battery voltage.
2	A	U	Place a 28-ohm resistor and a voltmeter across pins for 20 seconds and observe battery voltage. Remove 28-ohm resistor and voltmeter. Record battery voltage open circuit and underload.
3	U	C	Measure resistance.
4	U	F	Measure resistance.
5	U	J	Measure resistance.
6	U	S	Measure resistance.
7	U	P	Measure resistance.
8			Compare resistance readings in steps 3 through 7 with readings obtained in steps 1 through 5 of table 6-2. If values are the same, proceed.
9			With timer T2 reset, use ohmeter to determine timer contact position.
10	B	E	Check for open circuit contacts on activation switch AS-1.
11	D	H	Check for closed circuit contacts T2-S1 to valve V1.
12	D	S	Check for open circuit contacts T2-S2 to valve V2.
13	E	P	Check for open circuit contacts T2-S3 to valve V3.
14	R	N	Measure resistance of pressure transducer PR and convert to a pressure reading. If proper nitrogen pressure exists, proceed.
15	B	U	Check for open circuit and no voltage.

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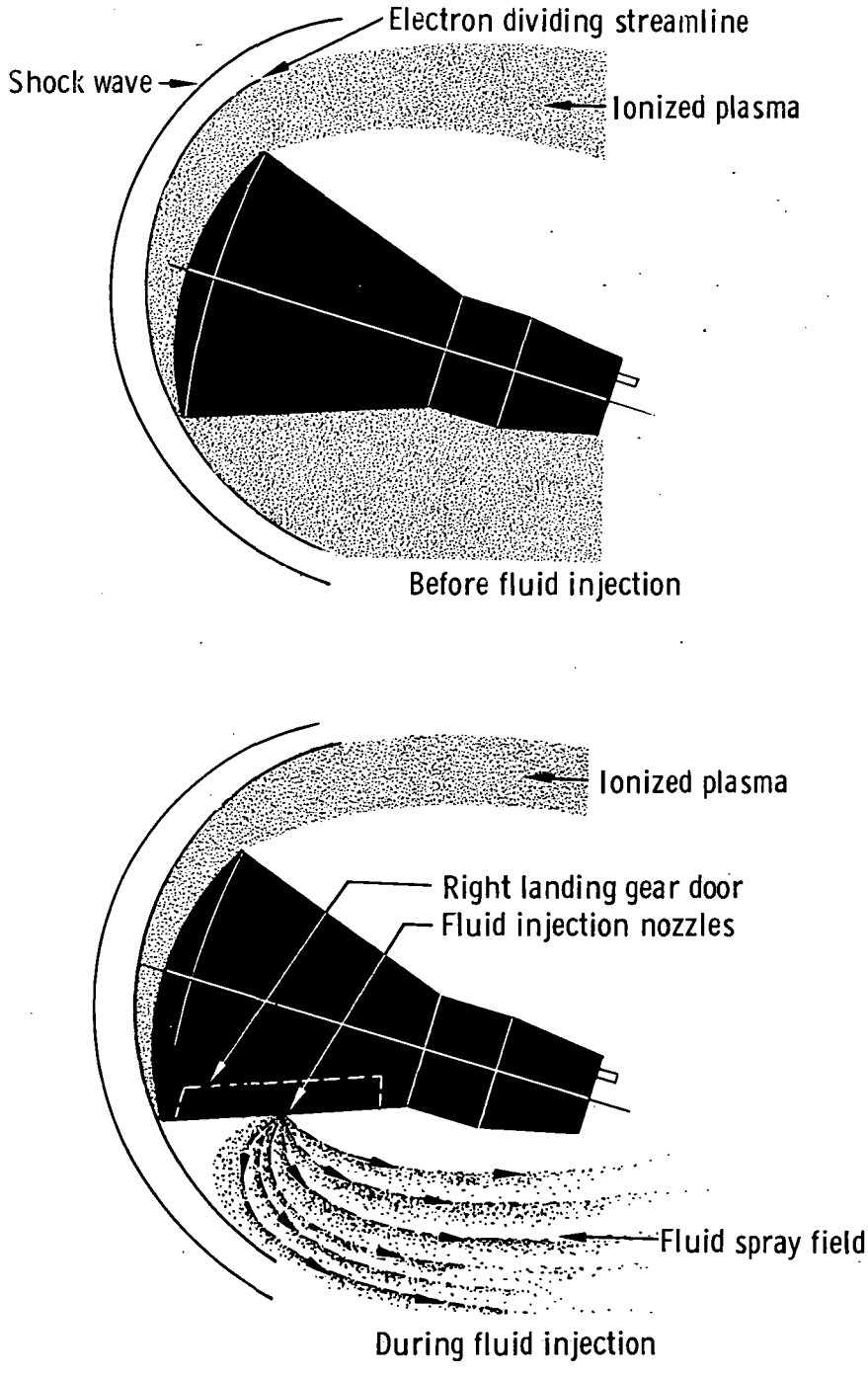

Figure 6-1.- Reduction of the reentry ionized plasma about a Gemini spacecraft by fluid injection.

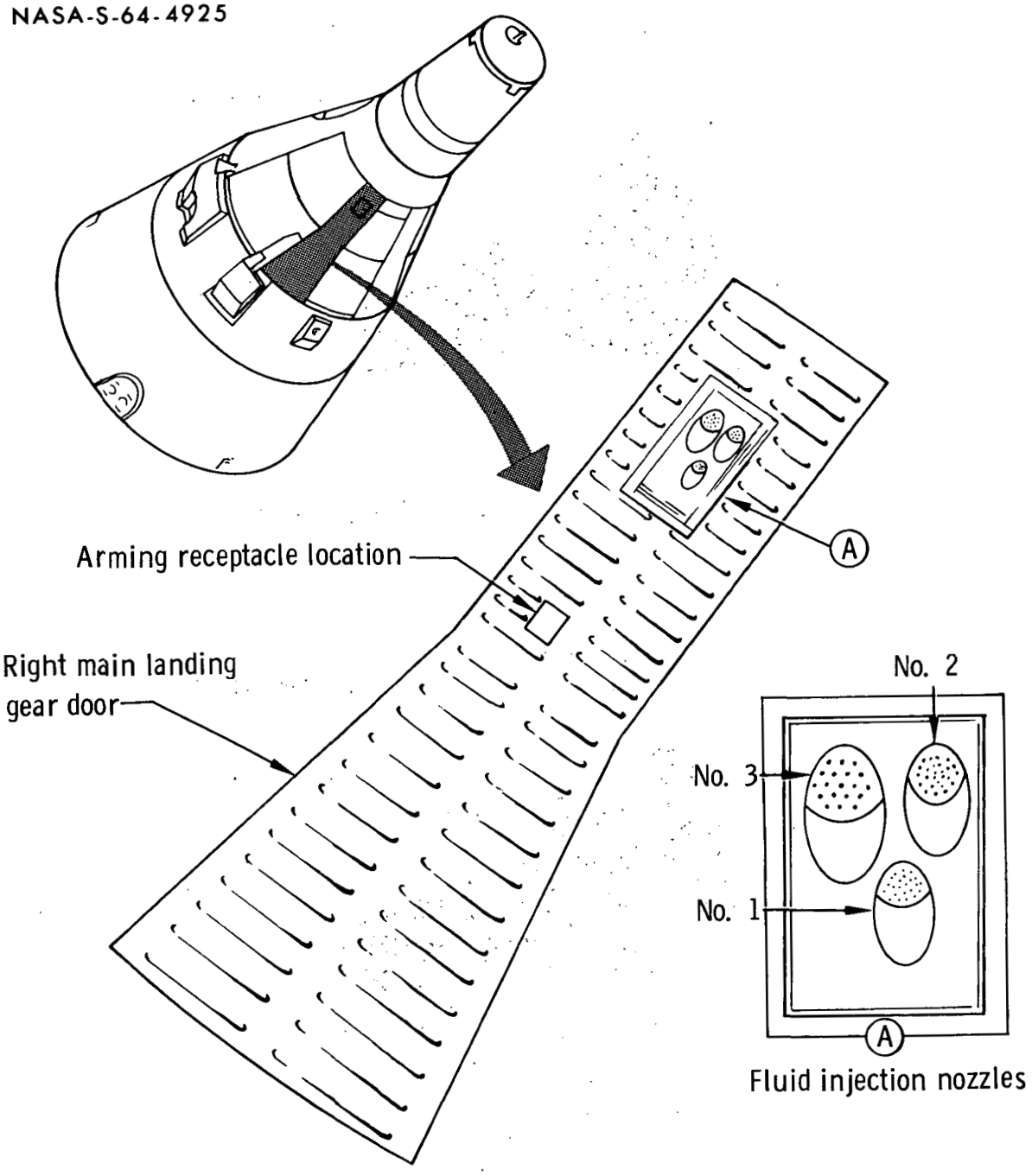

Figure 6-2.- Gemini spacecraft location of reentry communications experiment.

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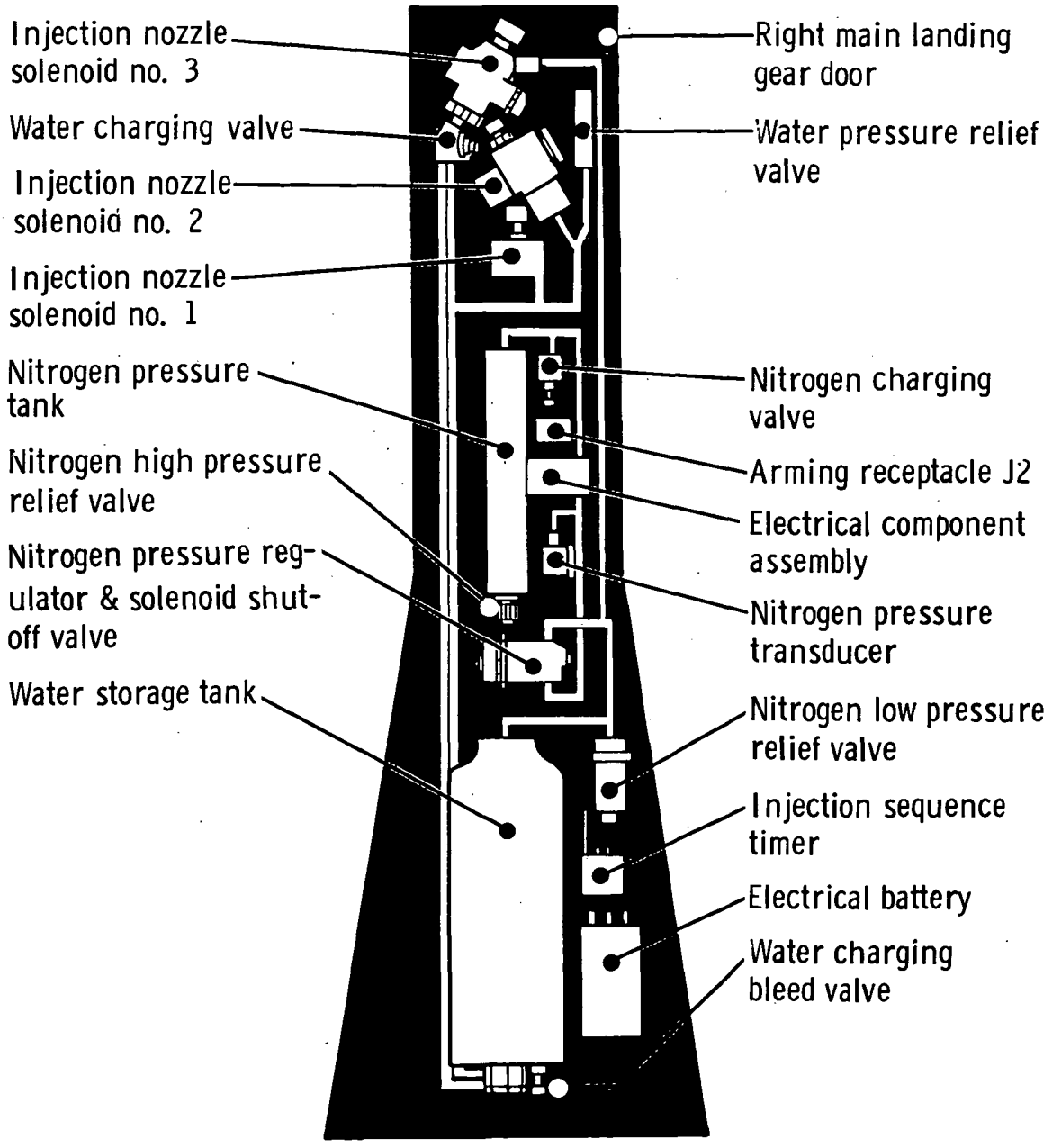

Figure 6-3.- Reentry communications experiment equipment installation on the inside of the right main landing gear door.

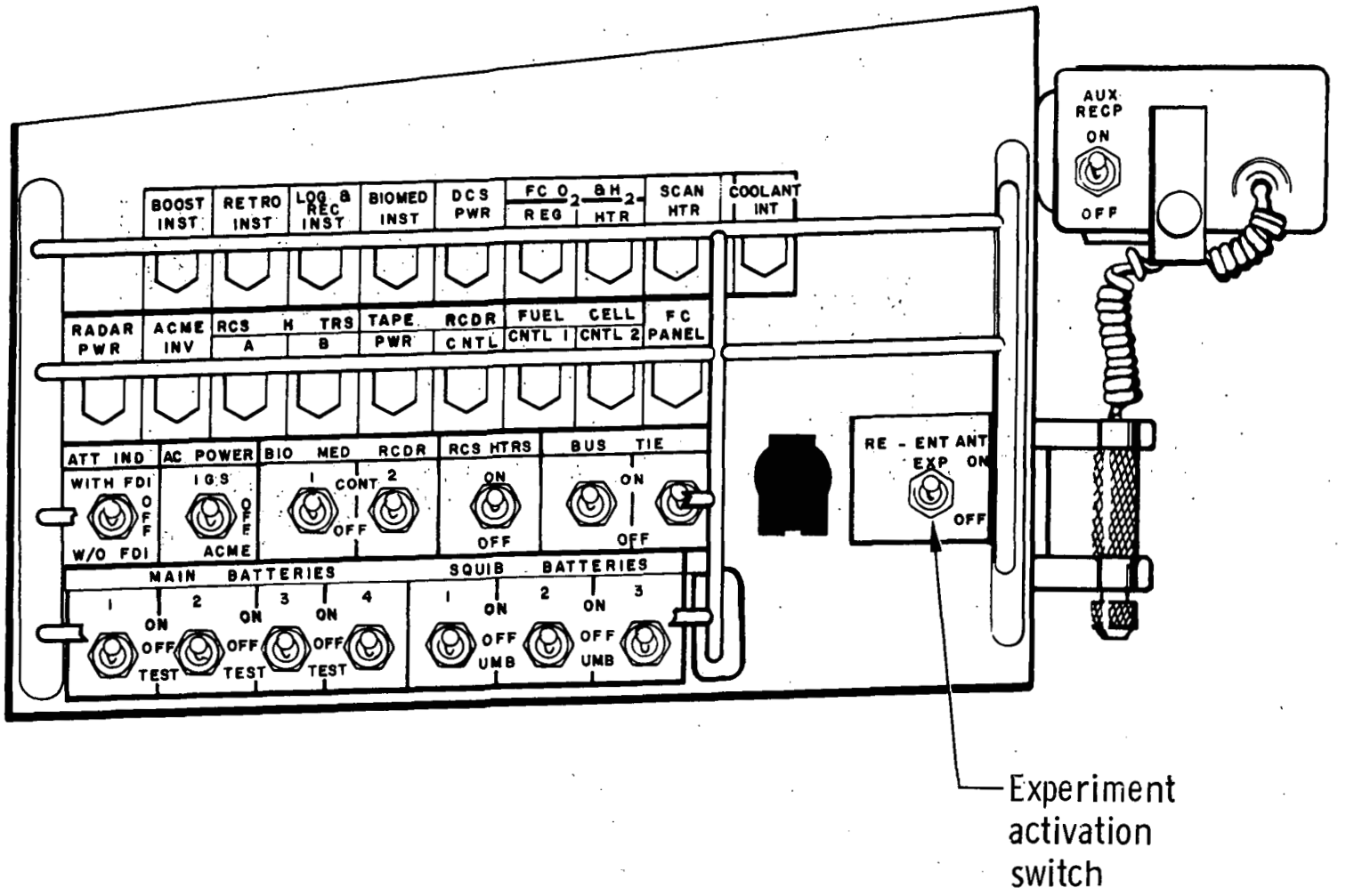

Figure 6-4.- Reentry communications experiment activation switch installation on the Gemini spacecraft panel.

NASA-S-64-4926

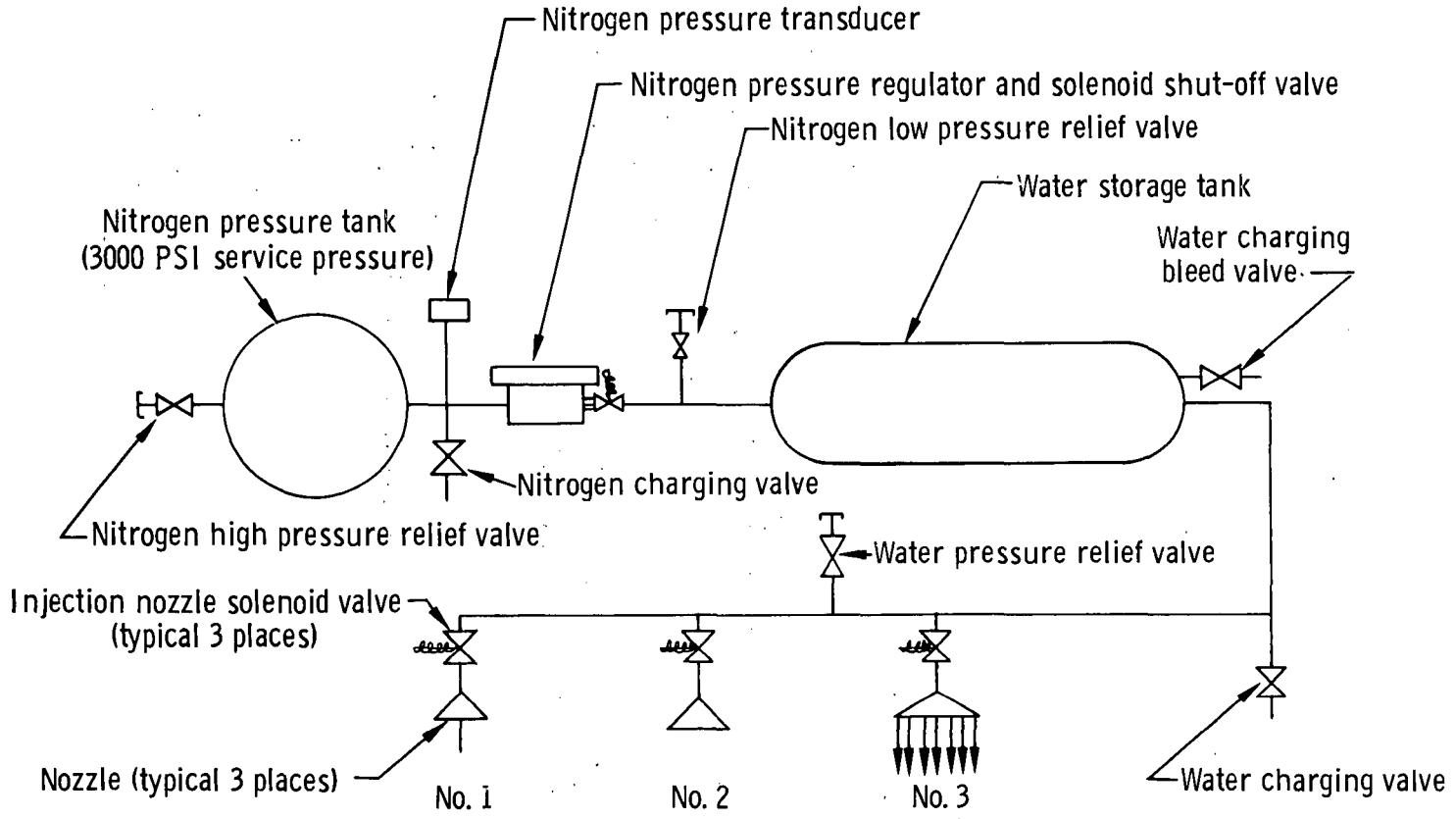

Figure 6-5.- Reentry communications experiment flow diagram.

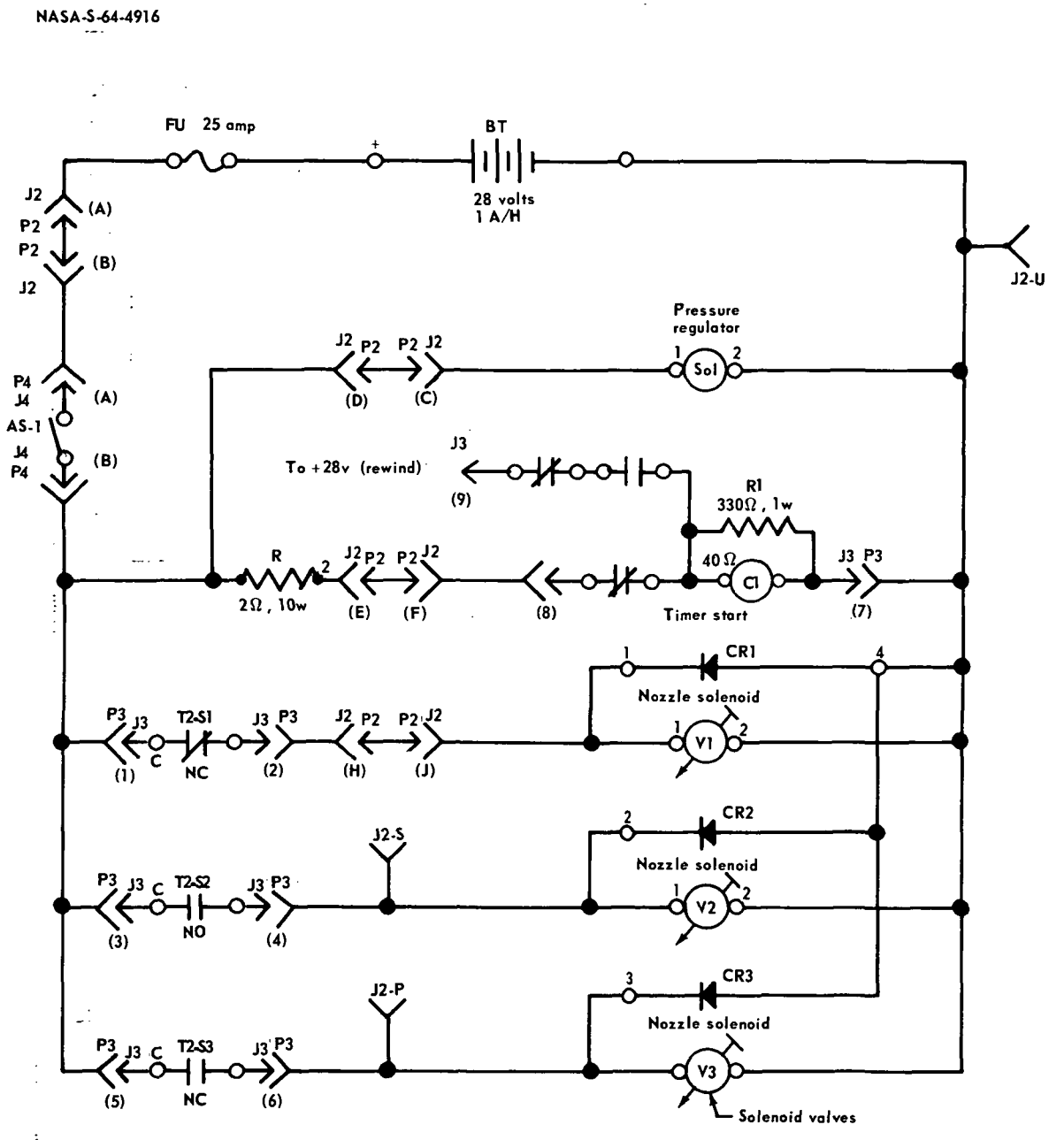

Figure 6-6.- Reentry communications experiment electrical schematic.

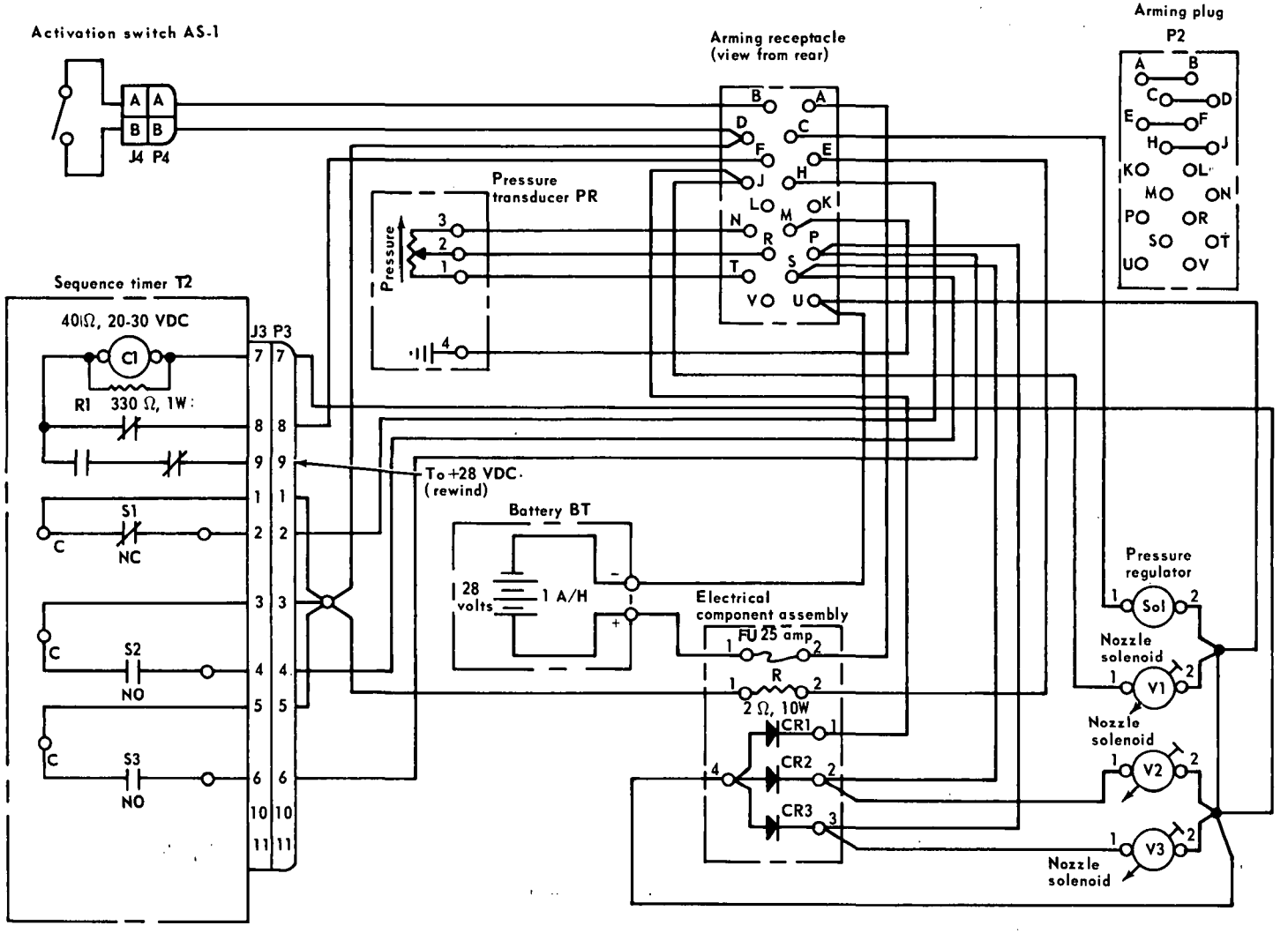

Figure 6-7.- Reentry communications experiment wiring diagram.